ENT COOPERATION TREATY

PCT

09/462171

INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference	FOR FURTHER ACTION	see Notification of Transmittal of International Search Report (Form PCT/ISA/220) as well as, where applicable, item 5 below.
110859.6		
International application No.	International filing date *(day/month/year)*	(Earliest) Priority Date *(day/month/year)*
PCT/IL 98/00329	14/07/1998	14/07/1997
Applicant		
TECHNION RESEARCH AND DEVELOPMENT FOUND. ...et al.		

This International Search Report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This International Search Report consists of a total of 3 sheets.

[X] It is also accompanied by a copy of each prior art document cited in this report.

1. [ ] **Certain claims were found unsearchable** (see Box I).

2. [ ] **Unity of invention is lacking** (see Box II).

3. [ ] The international application contains disclosure of a **nucleotide and/or amino acid sequence listing** and the international search was carried out on the basis of the sequence listing
   - [ ] filed with the international application.
   - [ ] furnished by the applicant separately from the international application,
     - [ ] but not accompanied by a statement to the effect that it did not include matter going beyond the disclosure in the international application as filed.
   - [ ] Transcribed by this Authority

4. With regard to the **title,**
   - [ ] the text is approved as submitted by the applicant
   - [X] the text has been established by this Authority to read as follows:

   MICROELECTRONIC COMPONENTS AND ELECTRONIC NETWORKS COMPRISING DNA

5. With regard to the **abstract,**
   - [X] the text is approved as submitted by the applicant
   - [ ] the text has been established, according to Rule 38.2(b), by this Authority as it appears in Box III. The applicant may, within one month from the date of mailing of this International Search Report, submit comments to this Authority.

6. The figure of the **drawings** to be published with the abstract is:

   Figure No. 3A/1

   - [X] as suggested by the applicant.
   - [ ] because the applicant failed to suggest a figure.
   - [ ] because this figure better characterizes the invention.
   - [ ] None of the figures.

INTERNATIONAL SEARCH REPORT

International Application No
PCT/IL 98/00329

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 H01L51/20 G06F15/80

According to International Patent Classification(IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 H01L G06F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5 561 071 A (HOLLENBERG CORNELIS P ET AL) 1 October 1996 see the whole document	1
A	US 5 089 545 A (POL ALEXANDER T) 18 February 1992 see the whole document	1,40,65, 67
A	WO 93 25003 A (UNIV YALE ;UNIV SOUTH CAROLINA (US); REED MARK A (US); TOUR JAMES) 9 December 1993 see the whole document	
A	US 3 833 894 A (AVIRAM A ET AL) 3 September 1974 see the whole document	

-/--

[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

° Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
1 October 1998	15/10/1998

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Königstein, C

1

Form PCT/ISA/210 (second sheet) (July 1992)

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication,where appropriate, of the relevant passages	Relevant to claim No.
A	US 5 063 417 A (HOPFIELD JOHN J) 5 November 1991 see the whole document	
A	WO 94 05045 A (UNIV CALIFORNIA) 3 March 1994 see the whole document	
A	D. B. HALL, R. E. HOLMLIN, J. K. BARTON: "Oxidative DNA damage through long-range electron transfer" NATURE, vol. 382, 22 August 1996, pages 731-735, XP002079217 London cited in the application see the whole document	
P,X	BRAUN E ET AL: "DNA-templated assembly and electrode attachment of a conducting silver wire" NATURE, 19 FEB. 1998, MACMILLAN MAGAZINES, UK, vol. 391, no. 6669, pages 775-778, XP002079216 ISSN 0028-0836 see the whole document	1-80
P,A	US 5 707 845 A (ISODA SATORU ET AL) 13 January 1998 see the whole document	

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No
PCT/IL 98/00329

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 5561071 A	01-10-1996	DE 3924454 A	07-02-1991
		EP 0491059 A	24-06-1992
		JP 3142882 A	18-06-1991
US 5089545 A	18-02-1992	NONE	
WO 9325003 A	09-12-1993	US 5475341 A	12-12-1995
		AU 4400093 A	30-12-1993
		CA 2134755 A	09-12-1993
		EP 0643883 A	22-03-1995
		JP 8501411 T	13-02-1996
		US 5589692 A	31-12-1996
US 3833894 A	03-09-1974	NONE	
US 5063417 A	05-11-1991	NONE	
WO 9405045 A	03-03-1994	US 5331183 A	19-07-1994
		JP 8500701 T	23-01-1996
		US 5454880 A	03-10-1995
US 5707845 A	13-01-1998	JP 2778304 B	23-07-1998
		JP 5075096 A	26-03-1993
		DE 4231610 A	01-04-1993

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International Bureau

INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 6 :
H01L 51/20, G06F 15/80

A1

(11) International Publication Number: WO 99/04440

(43) International Publication Date: 28 January 1999 (28.01.99)

(21) International Application Number: PCT/IL98/00329

(22) International Filing Date: 14 July 1998 (14.07.98)

(30) Priority Data:
121312 14 July 1997 (14.07.97) IL

(71) Applicant *(for all designated States except US)*: TECHNION RESEARCH AND DEVELOPMENT FOUNDATION LTD. [IL/IL]; Senate House, Technion City, Park Gootwirt, 32000 Haifa (IL).

(72) Inventors; and
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(74) Agent: REINHOLD COHN AND PARTNERS; P.O. Box 4060, 61040 Tel Aviv (IL).

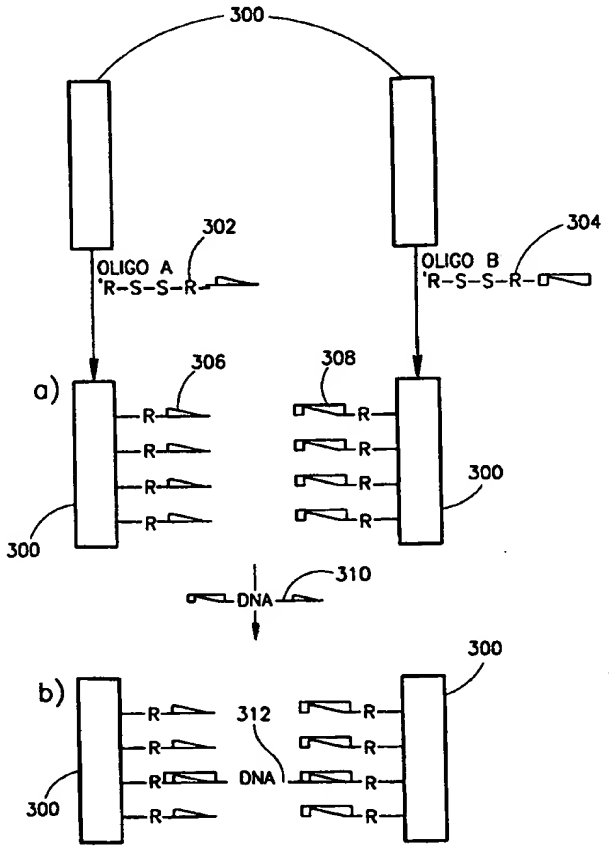
(81) Designated States: AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, DE, DK, EE, ES, FI, GB, GE, GH, GM, HR, HU, ID, IL, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, UA, UG, US, UZ, VN, YU, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).

Published
With international search report.

(54) Title: MICROELECTRONIC COMPONENTS AND ELECTRONIC NETWORKS COMPRISING DNA

(57) Abstract

A microelectronic network is fabricated on a fibrous skeleton by binding or complexing electronically functional substances to the nucleic acid skeleton. The skeleton comprises fibers with nucleotide chains. The assembly of the fibers into a network is based on interactions of nucleotide chain portions of different fibers.



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PATENT COOPERATION TREATY

PCT

09/462171

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference	FOR FURTHER ACTION	See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)
110859.6 RS		
International application No.	International filing date *(day/month/year)*	Priority date *(day/month/year)*
PCT/IL98/00329	14/07/1998	14/07/1997
International Patent Classification (IPC) or national classification and IPC H01L51/20		
Applicant TECHNION RESEARCH AND DEVELOPMENT FOUND. ...et al.		

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.

2. This REPORT consists of a total of 10 sheets, including this cover sheet.

   ☒ This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

   These annexes consist of a total of 5 sheets.

3. This report contains indications relating to the following items:

   - I ☒ Basis of the report
   - II ☒ Priority
   - III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
   - IV ☐ Lack of unity of invention
   - V ☒ Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations suporting such statement
   - VI ☐ Certain documents cited
   - VII ☒ Certain defects in the international application
   - VIII ☒ Certain observations on the international application

Date of submission of the demand	Date of completion of this report
02/02/1999	05.11.99
Name and mailing address of the international preliminary examining authority: European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465	Authorized officer Agne, M Telephone No. +49 89 2399 2631

Form PCT/IPEA/409 (cover sheet) (January 1994)

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No. PCT/IL98/00329

I. Basis of the report

1. This report has been drawn on the basis of (*substitute sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to the report since they do not contain amendments.*):

Description, pages:

1-52 as originally filed

Claims, No.:

1-31 with telefax of 28/10/1999

Drawings, sheets:

1/20-20/20 as originally filed

2. The amendments have resulted in the cancellation of:

☐ the description, pages:
☒ the claims, Nos.: 32-80
☐ the drawings, sheets:

3. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)):

4. Additional observations, if necessary:

II. Priority

1. ☐ This report has been established as if no priority had been claimed due to the failure to furnish within the prescribed time limit the requested:

   ☐ copy of the earlier application whose priority has been claimed.

   ☐ translation of the earlier application whose priority has been claimed.

2. ☐ This report has been established as if no priority had been claimed due to the fact that the priority claim has been found invalid.

Thus for the purposes of this report, the international filing date indicated above is considered to be the relevant date.

3. Additional observations, if necessary:

see separate sheet

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes:	Claims	5, 13-18, 20, 22, 25, 27-31
	No:	Claims	1-4, 6-12, 19, 21, 23, 24, 26
Inventive step (IS)	Yes:	Claims	5, 13-18, 20, 25, 28-31
	No:	Claims	1-4, 6-12, 19, 21-24, 26, 27
Industrial applicability (IA)	Yes:	Claims	1-31
	No:	Claims	

2. Citations and explanations

see separate sheet

VII. Certain defects in the international application

The following defects in the form or contents of the international application have been noted:

see separate sheet

VIII. Certain observations on the international application

The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made:

see separate sheet

Re Item II
Priority

1. The scope of the priority document is slightly different from the application document as filed. However, the priority is valid for the subject-matter of claims **1-4, 6-8,** and **28-31**. Furthermore, if claim **5** is interpreted as mentioned in section VIII of this International preliminary examination report, the priority is also valid.

   Claim **9** refers to chemically modified nucleotides carrying an amine residue, an active ester, or a carboxyl group. This is not disclosed in the priority document. Thus, claim 9 is not entitled to the claimed priority. The same applies to claims 10-27 in so far as they are dependent on claim 9.

Re Item V
Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Reference is made to the following documents:

   D3: J L Coffer et al, 'Dictation of the shape of mesoscale semiconductor nanoparticle assemblies by plasmid DNA', Appl. Phys. Lett. vol.69, no.6, p.3851-3853.

   D4: C A Mirkin et al, 'A DNA based method for rationally assembling nanoparticles into macroscopic materials', Nature vol.382, p.607-609

   D5: A P Alivisatos et al, 'Organization of "nanocrystal molecules" using DNA', Nature vol.382, p.609-611.

   D6: D B Hall et al., 'Oxidative DNA damage through long-range electron transfer' Nature, vol. 382, 22 August 1996, pages 731-735, XP002079217.

2. The subject-matter of claims **1-4, 6-12, 19, 21, 23, 24,** and **26** is not new in the sense of Article 33(2) PCT.

2.1 Document D5 (cf. Fig.1, the figure caption, and the corresponding description) discloses a network comprising a "fiber" (head-to head dimer, head-to-tail-dimer, head-to-tail trimer), said fiber comprising a nucleotide chain (template oligonucleotide), and one or more (one to three) particles (Au particles) bound thereto. Furthermore, D5 describes (see the caption of Fig.3) that this network was deposited on a carbon covered Cu net prior to transmission electron microscopy. Thus, the network was electrically connected to an electrically conducting interface component.

Consequently, the subject-matter of claim **1** is not new in the sense of Art. 33(2) PCT.

2.2 Document D3 (cf. column 2, line 3-14) discloses that it would be desirable to assemble polynucleotides into quantum wires, and it does also describe a method of rendering such polynucleotides conductive by depositing Cd^{2+} ions along the nucleotide chain. While the method is described with respect to a ring-shaped polynucleotide molecule in D3, it is also clear from D3 that the very same method can be applied to an elongated polynucleotide molecule. The particles in D3 are deposited on an amorphous carbon support film (column 4), thereby being connected to an electrically conducting interface component.

Thus, the disclosure of document D3 anticipates the subject-matter of claim **2**.

2.3 The "fibers" of the network shown in document D5 are connected to each other by sequence-specific nucleotide interaction.

Consequently, the subject-matter of claim **3** is also not new.

2.4 The head-to head dimer shown in document D5 (Fig.1) comprises two fibers (nucleotide chains), each bound to an Au particle via a linker molecule (L), and a further DNA molecule bound to each of the nucleotide chains.

Therefore, the subject-matter of claim **4** is not new in the sense of Art. 33(2) PCT.

2.5 Dependent claims **6-12, 19, 21, 23, 24,** and **26** do not contain any additional

features which, in combination with the features of any claim to which they refer, meet the requirements of the PCT with respect to novelty, the reasons being as follows:

Claim **6**: In D5, the polynucleotides have been chemically modified by attaching thereto sulphydryl (or thiol) groups, cf. the caption of Fig.1.

Claim **7**: In D5, the chemically modified nucleotides are included in the network in junction between a fiber and a linker that binds a fiber to the Au particle.

Claim **8**: In the nanocrystal assembly shown in D5, the chemically modified nucleotides each carry a member of a binding couple bound to another polynucleotide.

Claim **9**: see claim 6.

Claim **10**: Document D5 (cf. the head-to-head dimer in Fig.1) discloses a network comprising a fiber and an electronic component being a gold particle situated at the junction between two nucleic acid chains of two fibers. According to document D6, the DNA molecules are conductive at least to some extent (see the abstract), thus they meet the definition of a "wire" given in the present application.

Claim **11**: see claim 3.

Claim **12**: see claim 1 and the remark concerning the term "electronic component" in section VIII of this International preliminary examination report.

Claim **19**: see claim 3.

Claim **21**: see claim 1 and the remark concerning the term "network component" in section VIII.

Claim **23**: see claim 21.

Claim **24**: see claims 3 and 21.

Claim **26**: see claim 21.

3. The subject-matter of claims **22** and **27** does not involve an inventive step in the sense of Article 33(3) PCT.

3.1 Document D5 is concerned with the miniaturization of electronic components (cf. abstract). Thus, it would be obvious for the skilled person to use the nanocrystal assembly of D5 in an electronic circuit, for example, to determine its conductivity.

Thus, the subject-matter of claim **27** does not involve an inventive step in the sense of Art. 33(3) PCT.

In order to measure the conductivity, the skilled person would form the nanocrystal assembly of D5 between two electrodes in a circuit; thus, the subject-matter of claim **22** does also not involve an inventive step.

4. The subject-matter of claim **5, 13-18, 20, 25** and **28-31** is new in the sense of Article 33(2) PCT and involves an inventive step in the sense of Art. 33(3) PCT.

3.1 None of the available prior art documents shows a network comprising the technical features of claim **5** (interpreted as described in section VIII of this International preliminary examination report), nor does the teaching of these documents suggest such a network.

3.2 Although the DNA molecules in the nanocrystal assembly of D5 comprise Au particles bound thereto, there is no hint in D5 that their conductivity may be increased by the attached Au particles. Furthermore, since there are only very few Au particles per chain, the influence on the overall conductivity is likely to be negligible. Thus, the subject-matter of claim **13** appears to be new and inventive.

3.3 None of the available prior art documents shows a network comprising a wire formed by a non-metallic conducting substance bound to a fiber, or a fiber bound to a semi-conducting substance. Thus, the subject-matter of claims **14**, **15**, and consequently also claim **16** is new and inventive. For the same reason, the

subject-matter of claims **17, 18,** and **20** is new and inventive.

3.4 The subject-matter of claim **25** differs from the device shown in D5 in that the linker comprises a nucleotide chain, which is neither disclosed in nor rendered obvious by any of the available prior art documents.

3.4 The subject-matter of claim **28** is only disclosed in document D1. However, the subject-matter of claim 28 is disclosed in the priority document of the present application, thus the priority is validly claimed, and consequently, document D1 does not form part of the prior art.

3.5 Claims **29-31** are dependent on claim 28, and the priority is also valid for these claims.

Re Item VI
Certain documents cited

The following documents were published after the priority date, but prior to the filing date of the present application:

D1: E. Braun et al., "DNA-templated assembly and electrode attachment of a conducting silver wire", Nature, vol. 391, p.775-778, 19. Feb. 1998 (XP002079216).

D2: US-A-5 707 845

Re Item VII
Certain defects in the international application

1. None of the independent claims is in the two-part form in accordance with Rule 6.3(b) PCT, which in the present case would be appropriate, with those features known in combination from the prior art documents being placed in a preamble (Rule 6.3(b)(i) PCT) and with the remaining features being included in a characterising part (Rule 6.3(b)(ii) PCT).

2. The features of the claims are not provided with reference signs placed in parentheses (Rule 6.2(b) PCT).

Re Item VIII
Certain observations on the international application

1. The terms "fiber", "wire", "interface component", "electronic component" and "network", which are used in the claims, have a meaning which is different from the usual meaning of these terms. They are defined in the "Glossary" on pages 5-9 of the application.

1.1 The definition of the term "electronic component" given on page 8 of the description only comprises optional features ("may form part", "may be", "and others"). Since the term does not define any compulsory technical features, an "electronic component" in the sense of the application is to be regarded as being an "item".

Wherever the term "electronic component" is used in the claims, it has been interpreted in this sense.

1.2 Since the term "network component" (cf. page 8) refers to both a wire and an electronic component, a "network component" is also regarded as being an "item".

2. Claims **5** and **7** are not clear in the sense of Art. 6 PCT.

2.1 Claim **5** refers to a network comprising an entity, "*which entity changes from an electrically conducting to an electrically non-conducting state by transfer of electrons to or from said entity*". However, according to the description (see page 30, line 9 to page 31, line 9), the device acts like a single electron transistor, i.e., the state of the particle (600) changes once electrons are accumulated in the wire (622).

This contradiction renders the scope of the claim unclear.

In the light of the description, claim 5 has thus been interpreted as referring to a

network comprising an entity, which entity changes from an electrically conducting to an electrically non-conducting state by transfer of electrons to or from a part of said network.

2.2 It is not clear whether the subject-matter of claim **7** shall comprise at least one, or all, of the features (i), (ii) and (iii). This renders the scope of the claim unclear.

For the purpose of substantive examination, claim 7 has been interpreted as referring to an alternative, i.e. at least one of the features (i) to (iii) is to be present in the claimed subject-matter.

3. The description comprises several paragraphs (page 18, line 3 to line 10; page 24, line 6 to line 8; page 31, line 13 to line 15) which seem to imply that the subject-matter for which protection is sought may be different to that defined by the claims, thereby resulting in lack of clarity of the claims (Article 6 PCT

CLAIMS:

1. An electronic network with at least one network component, the network having a geometry defined by at least one fiber comprising one or more nucleotide chains.

2. A network according to Claim 1, wherein at least one network component is an at least one wire.

3. A network according to Claim 1, wherein at least one network component is an at least one electronic component.

4. A network according to any one of Claims 1-3, comprising at least two fibers connected to one another at a junction in which one nucleotide segment of one fiber is bound to another nucleotide segment of another fiber by a sequence-specific interaction.

5. A network according to any one of Claims 1-4, wherein at least one nucleotide chain has one or more substances, molecules, clusters of atoms or molecules or particles bound thereto or complexed therewith such that at least one electric or electronic component is formed with properties based on electric charge transport characteristics of said one or more substance, molecules, clusters or particles.

6. A network according to Claim 5, wherein said substance, molecule, cluster or particle is bound to said nucleotide chain through linkers.

7. A network according to Claim 5 or 6, having properties determined by the network's geometry and electric charge transport properties of said at least one electric or electronic component.

8. A network according to any one of Claims 1-7, comprising a junction formed between a nucleotide chain of one fiber and a nucleotide chain of another fiber, formed by a molecule, cluster of atoms or molecules or a particle bound to each of the nucleotide chains.

9. A network according to Claim 8, wherein said molecule, cluster or particle is bound to said nucleotide chains through linkers bound to said molecule, cluster or particle.

10. A network according to Claim 9, wherein said linkers comprise nucleotide sequences bound to the nucleotide chains by sequence-specific interaction.

11. A network according to Claim 8, wherein at least one of said molecules, clusters or particles contains metal atoms or ions.

12. A network according to any one of Claims 1-11, comprising a molecule, cluster of atoms or molecules or a particle which functions as a single electron transistor.

13. A network according to any one of Claims 1-12, comprising chemically modified nucleotides.

14. A network according to Claim 13, wherein the chemically modified nucleotides are included in junctions between fibers for binding the fibers to one another, serve to bind a fiber to a linker or serve to bind a fiber to an electronic component of the network.

15. A network according to Claim 13 or 14, wherein the chemically modified nucleotide carries one member of a binding couple for binding to another component comprising the other member of the binding couple.

16. A network according to Claim 15, wherein

said one member of the binding couple is a member of the binding couples of the group consisting of biotin-avidin, biotin-streptavidin, receptor-ligand, dig-antidig, antigen-antibody, sugar-lectin, nucleotide sequence-complementary sequence and a nucleotide chain and a nucleotide binding protein,

and the other member is the other of said couple.

17. A network according to Claim 13 or 14, wherein the chemically modified nucleotide carries a thiol, amine residue, an active ester or a carboxyl group.

18. A network according to any one of Claims 1-17, wherein the fibers have a nucleotide chain skeleton.

19. A network according to any one of Claims 1-18, having

(i) at least one conductor being a wire constructed on a fiber comprising at least one nucleic acid chain;

(ii) at least one electronic component being electrically connected to said at least one wire and being constructed either on a nucleic acid chain which has been chemically or physically modified by depositing one or more molecules, cluster of atoms or molecules or particles thereon rendering said chain to have electronic functionality, or being constructed by a molecule, cluster of atoms or molecules or a particle situated at a junction between two or more nucleic acid chains of different fibers rendering said junction to assume an electronic functionality, said electronic functionality being based on electric charge transport characteristics of said one or more molecules, cluster of atoms or molecules or particles.

20. A network according to any one of Claims 1-19, wherein said fibers are assembled to form the network on the basis of sequence-specific interaction of nucleic acid chains.

21. A network according to any one of Claims 1-20, comprising a nucleic acid chain which is electronically functionalized by binding one or more of said substances, molecules, clusters of molecules or atoms or particles thereto on the basis of non-sequence specific molecular recognition properties of the fibers.

22. A network according to any one of Claims 1-21, wherein at least one nucleic acid chain is electrically or electronically functionalized by sequence or domain-specific binding thereto of said substances, molecules, clusters of atoms or molecules or particles.

23. A network according to any one of Claims 1-22, wherein at least one nucleic acid chain is made electrically conductive by substances comprising a metal bound to the chain or portion thereof.

24. A network according to any one of Claims 1-23, wherein the network comprises at least one wire formed by non-metallic conducting substance bound to a fiber or portion thereof.

25. A network according to any one of Claims 1-24, wherein the network comprises molecules, clusters of atoms or molecules or particles bound at junctions between fibers.

26. A network according to any one of Claims 1-25, wherein at least one fiber has at least a portion bound to semi-conducting substances.

27. A network according to Claim 26, wherein the at least a portion, is a segment of a nucleotide chain.

28. A network according to any one of Claims 26, wherein one of two adjacent portions of at least one fiber are bound to a p-type semi-conducting substance and the other to an n-type semi-conducting substance, whereby the two adjacent portions of the fiber constitute a p/n junction.

29. A network according to Claim 27 or 28, wherein at least one of the two adjacent portions is a segment of a nucleotide chain.

30. A network according to any one of Claims 1-28, comprising at least one nucleotide-based junction formed by hybridization of complementary sequences of nucleotide chains in at least two fibers.

31. A network according to Claim 30, wherein nucleotides at the junction have either an n-type semi-conducting substance or a p-type

semi-conducting substance bound thereto with nucleotide sequences flanking the junction being deposited by the other of the n- or p-type semi-conducting substance, whereby the junction constitutes a bipolar transistor.

32. A network according to any one of Claims 1-31, comprising fibers having a skeleton made of nucleotides.

33. A network according to any one of Claims 1-31, comprising fibers having one or more polymer segments linked to one or more nucleotide chains.

34. A network according to any one of Claims 1-33, comprising at least one input/output interface component connected to at least one network component in a manner allowing electric conductivity between said interface component and said network component.

35. A network according to Claim 34, wherein the interface component is a metal electrode.

36. A network according to Claims 34 or 35, wherein said network component is connected to the interface component through a linker.

37. A network according to Claim 36, wherein the linker comprises a nucleotide chain.

38. A network according to any one of Claims 34 to 37, comprising at least two interface components, each one connected to at least one fiber or electronic component of the network.

39. An electronic circuit comprising a network according to any one of Claims 1-38.

40. Junction between two or more wires of an electronic circuit, wherein each of the wires has an end segment proximal to the junction comprising a nucleotide chain bound to another chain within the junction.

41. Junction according to Claim 40, wherein the binding of the nucleotide chains is by sequence-specific interactions.

42. Junction according to Claim 41, wherein the binding of the nucleotide chains is by a nucleic acid-binding protein.

43. Junction according to Claim 41, wherein the binding of the nucleotide chains is by two members of a binding couple, one bound to one nucleotide chain and the other to another nucleotide chain.

44. Junction according to Claim 43, wherein the binding couple is a member selected from the group consisting of biotin-avidin , biotin-streptavidin, dig-antidig, receptor-ligand, antigen-antibody, sugar lectin and nucleotide sequence-complementary sequences.

45. Junction according to Claim 40, formed with at least one modified nucleotide in at least one nucleotide chain.

46. Junction according to Claim 45, wherein the binding of the nucleotide chains is by a covalent bond between at least one nucleotide in one chain and at least one nucleotide in another chain.

47. Junction according to Claim 46, wherein said covalent bond is selected from the group consisting of a peptide bond or disulfide bond.

48. Junction according to Claim 45, wherein the modified nucleotide carries an atom or molecule for non-covalent interaction between the chains.

49. Junction according to any one of Claims 40-48, wherein the nucleotide chain has been chemically or physically modified to cause it to become electrically or electronically functional.

50. Junction according to Claim 49, wherein the nucleotide chain carries an electrically conducting substance.

51. Junction according to Claim 50, wherein said substance is metal.

52. Junction according to Claim 51, wherein said metal is silver or gold.

53. Junction according to Claim 50, wherein said metal is selected from the group consisting of cobalt, copper, nickel, iron and platinum.

54. Junction according to any one of Claims 40-53, comprising a molecule, a cluster of atoms or molecules or a particle bound to at least two nucleotide chains of different fibers.

55. Junction according to Claim 54, wherein said molecule, cluster or particle comprises metal atoms or ions.

56. Junction according to Claim 55, wherein said molecule, cluster or particle functions as a single electron transistor.

57. Junction according to any one of Claims 40-56, wherein at least one nucleotide chain has at least a portion having a semi-conducting substance bound thereto.

58. Junction according to Claim 57, wherein one segment of nucleotides of the junction have an n-type semi-conducting substance and another, adjacent segment has a p-type semi-conducting substance deposited thereon, thus forming a p-n junction.

59. Junction according to Claims 57 or 58, wherein nucleotides at the junction have either an n-type semi-conducting substance or a p-type semi-conducting substance bound thereto with portions flanking the junction being bound with a p-type or n-type semi-conducting substance, respectively, thus forming a bipolar transistor.

60. Junction between a conductor of a microelectronic circuit and an electrically conducting interface component, the conductor being a fiber comprising one or more nucleotide chains.

61. Junction according to Claim 60, wherein the fiber has a nucleotide end segment, and is bound to the interface component by a biomolecular interaction through a linker attached to the interface component.

62. Junction according to Claim 61, wherein the linker comprises a nucleotide chain, and said nucleotide end segment is bound thereto by sequence-specific interaction.

63. Junction between an electronic component of an electronic circuit and an electrically conducting interface component, comprising a nucleotide chain attached to one of the electronic components or to the interface component and bound by a biomolecular interaction to a linker attached to the other of the two components.

64. Junction according to Claim 63, wherein the linker comprises a nucleotide sequence bound to said nucleotide chain by a sequence-specific interaction.

65. A network component of a network as defined in any one of Claims 1-38.

66. A component according to Claim 65, selected from the group consisting of a switch, bipolar transistor, single-electron transistor, field effect transistor, diode, capacitor, resistor, conductor, light-emitting diode, insulator, inductor.

67. A wire comprising a nucleic acid fiber chemically or physically modified by binding thereto an electrically conducting substance such that electric current can flow along the fiber.

68. A wire according to Claim 67, wherein the electrically conducting substance is metal, non-metal conductor or any combination thereof.

69. A field effect transistor comprising a wire according to Claim 67 or 68 serving as its gate.

70. A component according to Claim 65, comprising a fiber having poly-phenylene vinylene derivative bound thereto, constituting a light producing component.

71. A method for making an electronic network, comprising:

(a) providing an arrangement comprising at least one electrically conductive interface component;

(b) attaching a linker to the at least one interface component;

(c) contacting said arrangement with at least one fiber comprising at least one nucleotide chain with a sequence capable of binding to the linker, and permitting binding of said sequences to said linker,

(d) electrically or electronically functionalizing the at least one nucleotide chain by depositing thereon or complexing thereto at least one substance or particles imparting electric or electronic functionality to the fibers.

72. A method according to Claim 71, wherein the network is formed by self-assembly as a result of chemical complementary and molecular recognition properties of at least one nucleotide chain to at least one other nucleotide chain or between at least one nucleotide chain and at least one specific sequence or domain-recognizing complexing agent.

73. A method according to Claim 71 or 72, comprising mixing fibers and components together and allowing them to self-assemble into a network in a specific manner.

74. A method according to any one of Claims 71-73, comprising forming junctions between nucleotide chains and at least one molecule, cluster of atoms or molecules or particles, said molecule clusters or particles serving as an electronic component in the network.

75. Kit for use in the manufacture of a network according to any one of Claims 1-38.

76. Kit for use in the manufacture of a junction according to any one of Claims 40-64.

77. Kit for use in the manufacture of a component according to Claim 65 or 66.

78. Reagent system for use in the manufacture of a network according to any one of Claims 1-38.

79. Reagent system for use in the manufacture of a junction according to any one of Claims 40-64.

80. Reagent system for use in the manufacture of a component according to Claim 65 or 66.